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DIAGNOSTIC CORNER

CYSTS OF THE LATERAL MENISCUS

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ABSTRACT

Accurate diagnosis and management of knee pain with or without mechanical symptoms challenges the physical therapist's clinical reasoning skills. Meniscal cysts are one relatively rare disorder of the knee that can cause both pain and mechanical symptoms and are frequently associated with a meniscal tear. In patients with suspected meniscal cysts, systematic differential diagnosis and sound clinical reasoning encourages appropriate integration of the clinical examination with diagnostic imaging. These case reports describe two different presentations of lateral parameniscal cysts where integration of the clinical examination with appropriate imaging allowed the physical therapist to provide a timely and appropriate intervention. In both cases, the diagnostic process is described along with the subsequent interventions that lead to positive outcomes.

Level of Evidence: 5 (Case Report)

Keywords: Differential diagnosis, imaging, meniscal cyst

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INTRODUCTION

Meniscal cysts were first reported in the literature in 1883 and the first detailed description was recorded in 1904.[1] They are relatively rare with reported incidence ranging from 1-8% in both histologic and magnetic resonance imaging (MRI) studies.[2–4] Cysts have been reported most frequently in 20-30 year old males.[1] They may represent a degenerative process or trauma;[1] approximately 50% are reportedly due to trauma.[5] The most common current theory of cyst development is they result from extrusion of synovial fluid through an adjacent meniscal tear.[3,6]

Until recently, clinicians believed cysts of the lateral meniscus were more common than cysts of the medial meniscus. Authors of recent studies utilizing advanced imaging techniques and arthroscopic visualization estimate that 59-66% of cysts occur medially, while 34-41% occur laterally.[2–4] Medial meniscal tears are reported more frequently than lateral meniscal tears,[7] although isolated lateral meniscus tears in high-level athletes may be more common.[8]

The physical characteristics of meniscal cysts are varied. They may present as parameniscal cysts, which are typified on MRI by a loculated fluid-intensity lesion with a clear connection to the adjacent meniscus.[2] They may also appear as intrameniscal cysts, which are defined as abnormally increased signal within an enlarged meniscus.[2] Reports of cysts associated with a palpable mass are also varied. Medial and lateral cysts were palpable on physical examination in 16% of a cohort including over 2,500 MRI reports.[3] Parameniscal cysts of the lateral meniscus are more commonly palpable with 20-60% of lateral cysts being detectable, while only 6% of medial cysts are palpable.[3,4] Sizes may range from 0.1–8.0 cm, with an average size of 1–2 cm.[2,3]

The majority of meniscal cysts are associated with underlying meniscal tears. Meniscal tears have been reported in association with meniscal cysts in 50-100% of cases.[2–4,9,10] The presence of a meniscal tear on MRI is defined as distinct high signal extending to an articular surface of the meniscus.[3] MRI often shows a simple horizontal cleavage tear or a complex meniscal tear with a horizontal component that directly communicates with the adjacent cyst.[3] Frequently, meniscal cysts are asymptomatic and are found incidentally on MRI performed to assess for other intra-articular pathology such as internal derangement or chondral abnormality.[2] Because 40-50% of meniscal cysts are associated with an articular surface meniscal tear, the absence of this finding does not rule out the possibility of a cyst.[2,3]

Accurate diagnosis and management of a patient with a suspected meniscal cyst may challenge the physical therapist's clinical reasoning skills. Differential diagnoses of a palpable or visible mass at the lateral knee and a mechanical block to motion are listed in Table 1. By utilizing the patient's history, clinical examination findings, diagnostic imaging results, and response to intervention to test diagnostic hypotheses, physical therapists make accurate diagnoses to facilitate optimal patient management. The authors present two case reports of patients with differing presentations of lateral parameniscal cysts and describe the aspects of patient management that facilitated a correct diagnosis and determined the most appropriate course of care.

Table 1. *Differential diagnosis of a patient with either a palpable mass at the lateral knee or a mechanical block to motion.*[1,11]

Patients with palpable visible mass at joint line	Patients with mechanical block to motion
Parameniscal cyst	Displaced bucket-handle meniscus tear
Osteophytes associated with DJD	Osteochondral defect or other loose body
Synovial cyst	Post-operative arthrofibrosis or cyclops lesion
Proximal tibiofibular joint cyst	Ganglion cyst
Traumatic bursitis	Meniscal cyst
Avulsion injury	Fracture
Tumor: pigmented villonodular synovitis, hemangioma, lipoma, synovial sarcoma	Tumor: pigmented villonodular synovitis, hemangioma, lipoma, synovial sarcoma

CLINICAL PRESENTATION

Patient #1. The patient was a 19 year-old male United States Military Academy Cadet who self-referred to physical therapy with a chief complaint of right knee pain and stiffness following a hyper-flexion injury during a wrestling match the day prior. The patient reported severe pain, rated eight out of ten on a numerical pain rating scale (NPRS), localized to the lateral joint line of the knee. The patient reported swelling and locking of the knee, but denied giving way or feeling of instability. While he denied any prior knee injuries, he stated that over the past three months he experienced intermittent stiffness and a catching sensation in the knee. The patient denied any neurological symptoms and hip or lumbar spine pain.

Patient #2. The patient was a 35 year-old female United States Navy Corpsman referred to physical therapy by her primary care physician with a diagnosis of patellofemoral pain syndrome. At the time of the initial evaluation, she was an instructor whose physical fitness activities included running three to four days per week with a total weekly mileage of 12-15 miles. No radiographs or advanced imaging were performed previously. She presented to physical therapy with an insidious onset of right lateral knee pain over the past 3 months, which she described as an intermittent, sharp, pain associated with swelling. A secondary complaint was intermittent burning and tingling in the anterolateral leg. The patient felt that the leg and knee symptoms were related to each other because the leg symptoms were present only when her knee symptoms were worst. On a NPRS, both symptoms ranged from zero to seven out of ten. While running caused knee pain, it would resolve after a quarter to a half-mile distance. Symptoms increased with prolonged sitting with the knee flexed and ascending or descending stairs and lessened when sitting with the knee extended. The patient did report pain that was intermittently worse at night, with difficulty falling back asleep. She denied a specific injury, major change in training surface or level, feeling of instability, or locking. She also denied a previous history of knee pain or injury and hip or lumbar spine pain.

CLINICAL EXAMINATION

Patient #1. Physical examination consisted of a thorough neuromusculoskeletal evaluation of the knee. The patient was a fit, athletic male without visible deformity or muscle atrophy. There was moderate effusion of the right knee. Active range of motion demonstrated extension to neutral (lacked 10 degrees from the uninvolved) and flexion to 110 degrees (lacked 20 degrees from the uninvolved). Passive extension of the knee produced sharp lateral knee pain with a spongy end-feel with moderate end range overpressure. Passive flexion of the knee produced both lateral knee pain with moderate end range overpressure. There was tenderness to palpation at the lateral joint line, a positive McMurray's test laterally, and positive Apley's compression test laterally. Ligamentous stress tests of the knee demonstrated a stable knee joint. Manual muscle testing of the knee extensors and flexors was deferred due to pain. A neurological screening did not reveal any sensory deficits.

Patient #2. The physical examination was a thorough evaluation of the knee, followed by the hip, lumbar spine, foot, and ankle that progressed in breadth and depth over the course of three patient visits. The patient was a fit, athletic female without any visible muscle atrophy of the lower extremities. There was an approximately 1-2 cm local mass at the anterolateral joint line of the right knee. Active range of motion demonstrated extension to neutral (lacked 5 degrees from the uninvolved) and flexion to 120 degrees (lacked 10 degrees from the uninvolved). Passive extension of the knee produced lateral knee symptoms with firm end feel upon overpressure. Passive flexion of the knee produced both lateral knee and anterolateral leg symptoms with firm, end range overpressure. Passive posterior to anterior movement of the proximal tibiofibular joint produced lateral knee pain with firm, end range overpressure. There was tenderness to palpation with a palpable mass at the lateral joint line and a positive McMurray's test laterally. Functional squat was limited to 60 degrees of knee flexion due to lateral knee pain. Ligamentous stress tests of the knee demonstrated a stable knee joint. Manual muscle testing of the lower extremity revealed no quadriceps or hamstrings weakness and 4+/5 hip abduction strength bilaterally. At the patellofemoral joint, there was no tenderness to palpation or passive movement findings. The hip joint and lower lumbar spine were both cleared with firm overpressure to passive movement and palpation. A neurological screening did not reveal any motor or sensory deficits.

DIAGNOSIS AND IMAGING

Diagnosis of meniscus tears and cysts typically occurs by clinical examination or MRI. There are currently no valid clinical examination special tests for meniscal cysts. Although joint line fullness correlated well with the presence of a meniscal tear, it did not correlate well with the presence of a meniscal cyst in a recent prospective cohort study.[11]

In 1947, Dr. Pisani described a pathognomonic sign in his report of 31 cases of meniscal cysts. He stated that in all 31 cases, "A hemispherical cystic mass disappeared into the knee joint on acute flexion and reappeared on extension of the knee, reaching its maximum dimensions at a point 25-30 degrees short of complete extension."[12] The "Pisani sign" was recently examined in 11 consecutive patients with lateral knee swelling most prominent at 30-45 degrees of knee flexion and arthroscopically confirmed lateral parameniscal cysts.[12,13] In a modification of the maneuver, external rotation of the tibia caused the lateral mass to become more prominent, while internal rotation of the tibia caused the mass to completely disappear.[13]

Because of the association with parameniscal cysts and a presentation with similar mechanical symptoms, the clinical examination may include diagnostic tests for meniscal tears. The diagnostic accuracy of joint line tenderness and the McMurray's test to detect meniscal tears has recently been reported in a meta-analysis.[14–16] The Thessaly test is a relatively new test which is promising for the detection of meniscal injuries.[14,17,18] Table 2 shows the diagnostic accuracy of individual clinical examination special tests and MRI to detect meniscal tears. The accuracy of the clinical examination may improve when clinical tests are used in combination. If a patient presents with a positive McMurray's test, joint line tenderness, pain with extension overpressure, pain with flexion overpressure, and a history of mechanical symptoms the positive likelihood ratio (+LR) is 11.0; with four positive tests of the five previously listed the +LR is reduced to 4.3.[19] Careful evaluation by an experienced examiner may identify meniscal lesions with equal or superior accuracy as MRI.[20,21]

Patients with lateral parameniscal cysts may also present with signs and symptoms of fibular (peroneal) nerve compression. Patient #2 reported symptoms along the anterolateral leg related her lateral knee pain. Fibular (peroneal) nerve palsy with associated foot drop was previously reported in a 26 year-old patient with a mass at the lateral knee and subsequent diagnosis of an oblique tear of the lateral meniscus with a multi-loculated cyst extending from the anterior lateral meniscus.[22] Two cases of lateral meniscal cysts that were not palpable and caused fibular (peroneal) nerve symptoms that resolved with surgical intervention were reported as early as 1967.[23]

Radiographs remain the first-line imaging modality in acute trauma to the knee and atraumatic knee disorders.[24,25] In both cases reported here, the physical therapists possessed advanced clinical privileges that included the ability to order imaging. Each physical therapist ordered radiographs at completion of the initial evaluation. The choice of views for the acute traumatic injury of Patient #1 were anterior-posterior (weight-bearing), lateral, sunrise, and tunnel views. The choice

Table 2. *Diagnostic test properties for the clinical examination and MRI in the diagnosis of meniscal tears. Abbreviations: Sn, sensitivity; Sp, specificity; +LR, positive likelihood ratio; -LR, negative likelihood ratio; MRI, magnetic resonance imaging.*

Test	Sn	Sp	+LR	-LR
Joint line tenderness[15-17]	0.63 – 0.76	0.77	2.7 – 3.3	0.31 – 0.48
McMurray test[15-17]	0.55 – 0.71	0.71 – 0.77	2.4 – 2.5	0.41 – 0.58
Thessaly test[15, 18-19]	0.89 – 0.92	0.96 – 0.98	23.0 – 39.3	0.08 – 0.11
Apley's test[15-17]	0.22 – 0.61	0.70 – 0.88	1.8 – 2.0	0.56 – 0.89
Clinical composite score: 4-5 positive tests[20]	0.11 – 0.17	0.96 – 0.99	4.3 – 11.0	0.87 – 0.90
MRI[21-22]	0.46 – 1.0	0.66 – 1.0	1.4 – 99.0	0.10 – 0.82

of views for the atraumatic chronic knee pain of Patient #2 were anterior-posterior, lateral, and sunrise views. Normal radiographs in both cases excluded a soft tissue calcification or a bone lesion (Figure 1 & Figure 2).

MRI is the imaging modality of choice for the diagnosis of soft tissue injuries, such as meniscus tears and cysts.[24,25] MRI is indicated in cases where initial radiographs are nondiagnostic and there is suspicion of internal derangement, or when the patient has persistent knee pain and normal radiographs.[24,25] Based on a suspicion of meniscus pathology with a block to motion, a MRI exam was ordered acutely for Patient #1 which is consistent with American College of Radiology Appropriateness Criteria for imaging acute knee trauma.[24] Images showed a complex lateral meniscus tear, including a large radial tear, involving the anterior horn and body and a large parameniscal cyst located anteromedial to the periphery of the lateral meniscus, measuring approximately 2.1 x 0.6 x 0.6 cm in diameter (Figure 3 & Figure 4). From the sagittal image in Figure 4, one can appreciate how a cyst in the anterior portion of the tibiofemoral joint could cause a block to extension movement of the knee. Additional findings

Figure 1. *A conventional anterior-posterior radiograph of the knee of patient #1 does not reveal an anatomic basis for the patient's signs and symptoms.*

Figure 2. *A conventional anterior-posterior radiograph of the knee of patient #2 does not reveal an anatomic basis for the patient's signs and symptoms.*

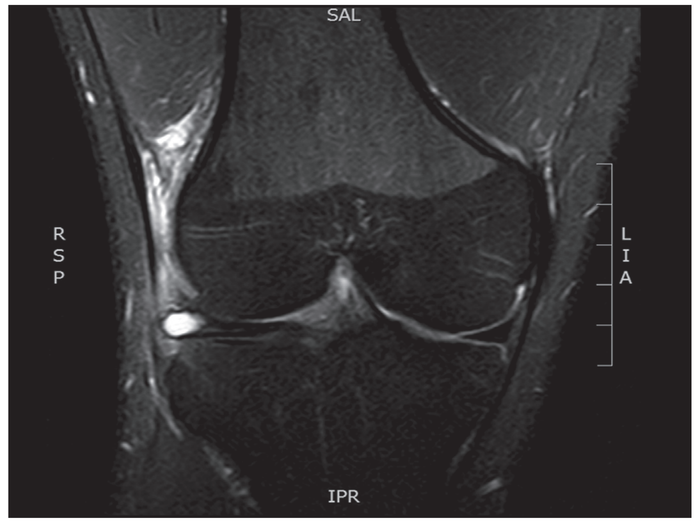

Figure 3. *A coronal slice T2-weighted MR image shows a large anterolateral parameniscal cyst, demonstrated by the discrete, well-defined hyperintense signal adjacent to the meniscus.*

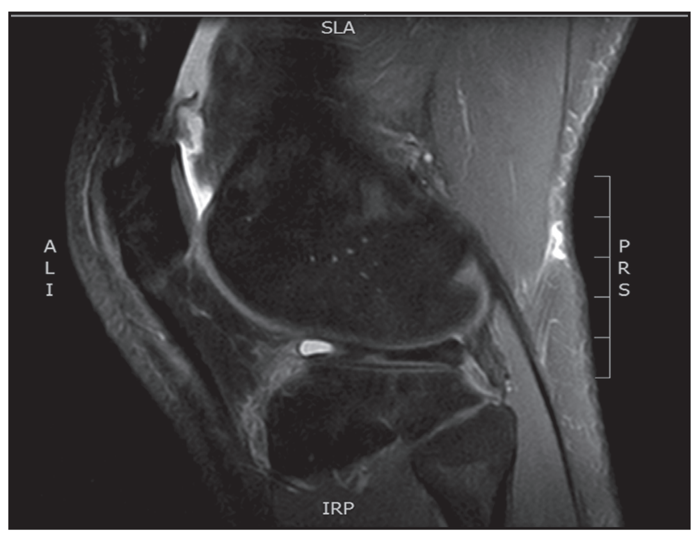

Figure 4. *A sagittal slice T2-weighted MR image shows the parameniscal cyst as it resides in the anterior portion of the lateral meniscus, demonstrated by the discrete, well-defined hyperintense signal adjacent to the meniscus.*

included a mild patellar tendinosis and mild prepatellar bursitis. After the third visit for Patient #2, the physical therapist ordered a MRI exam of the right knee which showed a horizontal-oblique tear of the anterior horn and body of the lateral meniscus and a lobulated parameniscal cyst along the lateral joint line measuring 2.0 x 0.7 x 2.6 cm (Figure 5 & Figure 6). On the sagittal image in Figure 5, the tear does appear to extend to the articular surface. Additional findings included an area of chondral loss and fissuring over the weight-bearing posterolateral tibial plateau and patellofemoral chondral degeneration.

INTERVENTIONS

Patient #1 was referred to an orthopedic surgeon based on the clinical examination and the results of the MRI. Surgical intervention occurred within one week and consisted of an arthroscopic cyst decompression with a partial lateral menisectomy. Excision of approximately 15% of the lateral meniscus was required to debride that structure back to a stable rim. Post-operative rehabilitation commenced 24 hours following surgery and followed a post-operative protocol typical for an arthroscopic partial menisectomy. During the subsequent eight weeks, the patient progressed from muscle activation and range of motion exercises to weight bearing functional exercises focused on improving the strength and endurance of the quadriceps, hamstring, and gluteals. A stationary bike was utilized initially to maintain cardiovascular conditioning until the patient began a run progression program.

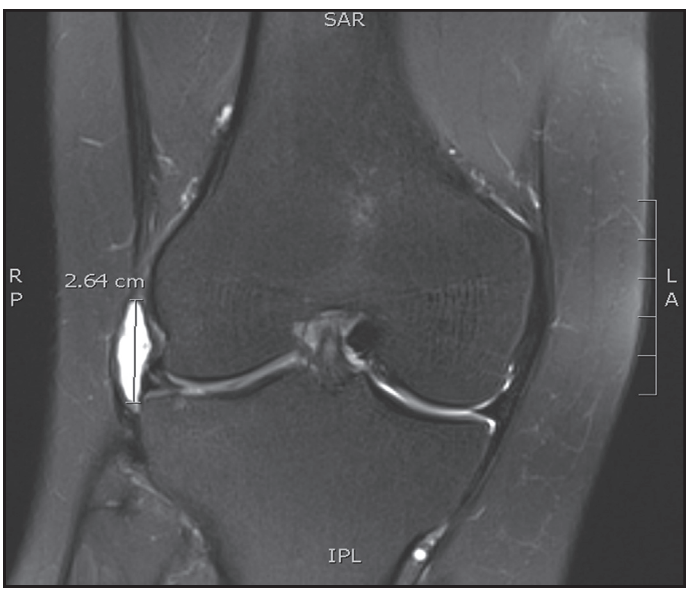

Figure 5. *A coronal slice T2-weighted MR image shows a very large anterolateral parameniscal cyst, demonstrated by the discrete, well-defined hyperintense signal adjacent to the meniscus, in addition to a horizontal-oblique lateral meniscus tear, demonstrated by the linear hyperintense signal within the lateral meniscus that extends to the articular surface.*

Figure 6. *A sagittal slice T2-weighted MR image shows the lateral meniscus tear, demonstrated by the linear hyperintense signal within the lateral meniscus, in addition to an area of chondral loss and fissuring over the weight-bearing posterolateral tibial plateau, demonstrated by the area of hyperintense signal within the articular surface of the tibial plateau.*

Meniscal cysts are most frequently treated surgically by arthroscopic menisectomy and either a percutaneous or arthroscopic cystectomy.[1,5,9,10] Previously, a total menisectomy with removal of the cyst was performed; currently, partial menisectomy is favored to preserve the weight-bearing function of the meniscus.[1] The combination of arthroscopic partial menisectomy with cystectomy yields excellent or good results in over 80% of patients; excellent outcome is defined as asymptomatic with no recurrence of the cyst and good outcome is defined as mild symptoms with no recurrence of the cyst.[9,10,26]

Cysts may also be treated invasively with a large-bore needle aspiration[1] with or without a corticosteroid injection. A recent case report described a meniscal cyst that recurred after one year after arthroscopic debridement that was treated with ultrasound guided needle aspiration followed immediately by corticosteroid injection.[27] At one year following this intervention, the patient reported mild improvement and desired no further intervention.[27]

Patient #2 was treated once per week for four weeks consisting of impairment-based manual physical therapy and reinforcing range of motion and strengthening exercises while imaging was ordered and interpreted. The impairment-based approach was a complex patient-centered process that utilized clinical reasoning and careful decision making to tailor the examination and treatment to the patient. Manual physical therapy was progressed in both the grade of movement and duration of treatment from the tibiofemoral joint to the proximal tibiofibular joint and patellofemoral joint based on the results of the clinical examination. The home exercise program consisted of strengthening (gluteals, quadriceps, hamstrings) and range of motion exercises to reinforce manual techniques. In this patient, a proximal tibiofibular joint posterior to anterior glide treatment technique[28] had the largest effect within-session, suggesting that this joint was contributing to some aspect of the patient's disorder. This technique was progressed in both grade of movement and duration with grade five thrust manipulations performed at the final treatment session.

While physical therapy interventions will not structurally change a patient's meniscal tear or cyst, the presence of pathology does not preclude initiation of physical therapy treatment, focused on specific impairments to movement, to restore function and potentially avoid a more invasive intervention associated with increased risk. Orthopaedic manual physical therapy utilizes a tailored examination and treatment approach which has been shown to be effective in reducing pain and improving function in a variety of musculoskeletal conditions.[29–34] While manual physical therapy is one treatment approach in a patient with movement dysfunction, exercise programs may also produce positive changes in pain and function. The physical therapist should tailor exercise programs to the individual patient for maximal effectiveness.[35] In patients with knee osteoarthritis, non-tailored exercise programs produce small changes while more comprehensive, but not personally tailored, exercise programs that address typical impairments to strength and movement may have small to moderate effects.[35,36]

OUTCOMES

The Global Rating of Change (GRC) score, Single Assessment Numeric Evaluation (SANE) score and the Lysholm Knee Scoring Scale captured changes in self-reported function. The GRC is a valid and useful method for assessing the overall change in the quality of life of a person.[37] The SANE score is determined by the patient's response to the following question: "On a scale from zero to 100, how would you rate your knee today (100 being normal?)" . The SANE correlates well with measured Lysholm Knee Scoring Scale scores in patients with anterior cruciate ligament reconstruction.[38] The Lysholm Knee Scoring Scale was developed to evaluate outcomes of knee ligament surgery, but is now utilized in a variety of knee conditions.[39] It is an eight-item questionnaire with scores ranging from zero to 100; a score of 100 indicates no symptoms or disability. The Lysholm Knee Scoring Scale is reliable and valid in various knee disorders.[39] The NPRS captured changes in self-reported pain. The scale is an 11 point (0, no pain to 10, worst possible pain) scale that measures a subject's subjective report of pain and is a valid and reliable measure of pain.[40,41]

After eight weeks of post-operative rehabilitation, Patient #1 reported a GRC score of 6 (a great deal better), a SANE score of 75% and reported that his worst overall pain was 2/10 on a NPRS. Range of motion of the knee was slightly reduced in both flexion and extension, but not painful to moderate overpressure. The patient was able to complete a six-week summer training program consisting of high intensity activity that included running, jumping, climbing, lateral movements, and obstacle courses.

After four weeks of treatment, Patient #2 reported a GRC score of 4 (moderately better). Her Lysholm Knee Scoring Scale score was 12 compared to 36 at the initial evaluation. She reported that her worst overall pain had improved from seven to two out of ten on a NPRS. Despite the presence of a meniscal tear and parameniscal cyst, she was able to jog three miles without increased pain or swelling and was able to complete all military duties without any limitations. Examination of the knee did not reveal any limitations to movement with firm end-range overpressure to the tibiofemoral, patellofemoral, or proximal tibiofibular joints. There was still a positive McMurray's test laterally and a visible/palpable mass at the lateral knee, reduced in size from the initial evaluation. At an evaluation for another musculoskeletal complaint 12 weeks from her initial evaluation for her knee, this patient continued to be able to run and perform military duties without limitations.

RECOMMENDATIONS

These case reports highlight the evaluation and treatment of two patients with different presentations of lateral parameniscal cysts. Meniscal cysts are relatively rare, but may be present in patients with complaints of knee pain. The majority of cysts are associated with meniscal tears and are often identified incidentally during MRI examination for a suspected internal derangement.[1–3]

Accurate diagnosis facilitates timely and appropriate intervention. In patients with a traumatic injury and mechanical block to knee motion, the differential diagnosis should include the presence of a meniscal cyst in addition to a bucket-handle meniscus tear, osteochondral defect, other loose body, or fracture. In patients with a visible or palpable mass at the joint line, a parameniscal cyst should also be included in the differential diagnosis.

Radiographs remain the initial imaging choice in both traumatic and atraumatic knee pain. If patient presents with a mechanical block to motion, early MRI may be considered if plain radiographs are normal. Otherwise, MRI evaluation without contrast may supplement the clinical examination if the patient fails to make progress with rehabilitation and initial radiographs were normal.

Surgical intervention is likely necessary if there is a block to mechanical motion, as occurred in Patient #1. Cyst decompression and treatment of the meniscal tear prevents joint contracture. In cases without a mechanical block, the treatment approach should focus on restoring normal joint function, including strength, endurance, active range of motion, and passive physiologic and accessory movements. If a patient fails to improve with an appropriate period of rehabilitation, the physical therapist may consider referral to an orthopaedic surgeon.

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